

# **ROLE OF TRANSMISSION IN DEREGULATED MARKETS: THE PHILIPPINES EXPERIENCE**

**Mr Gregorio R Cayetano  
Manager, Network Operations Department  
National Power Corporation  
Philippines**

**GREGORIO R. CAYETANO**

Manager, Network Operations Department  
National Power Corporation, Philippines

Mr. Cayetano took his electrical engineering course in Mapua Institute of Technology in the Philippines. Upon passing the board examination he was immediately hired as Electrical Engineering Aide in 1974 by the National Power Corporation and was stationed at the Binga Hydroelectric power plant in Northern Luzon. Six months after, he was transferred to Angat Hydroelectric Power Plant and was later promoted as Power Switchboard Engineer.

In 1978 he assumed the position of Power System Control Engineer at the System Operations Department. He was promoted as Shift Manager effective July 1983. In 1995 he assumed the position of Department Manager of Network Operation Department of the System Operations Group. He pursued his Master in Business Administration at the Philippine Women's University and was able to graduate in 1997.

He is a Career Executive Service Officer with a rank of CESO V. Career Executive Board is giving this eligibility after hurdling and passing four qualifying examinations.

He rose from the ranks and he had already accumulated 28 years of service in the energy sector. His responsibilities are generation, distribution and transmission dispatching functions of the system operator including approval of transmission line outage scheduling in the Luzon Power Grid.

**Role of Transmission in Deregulated Markets:  
Philippines Experience**

**GREGORIO R. CAYETANO**

Manager Network Operations Department  
System Operations  
National Transmission Company  
National Power Corporation  
Philippines

## Role Of Transmission In Deregulated Markets: Philippines Experience

### Abstract

Before the generation and transmission of electricity are **Government Owned and Controlled Corporation (GOCC)** dominant. Now with the passing of the “**Electric Power Industry Reform Act of 2001**” (**RA 9136**), soon both the generation and transmission of electricity shall be privatized. RA 9136 mandates the **National Power Corporation (NPC)** to spin off its transmission and system operation groups by the end of 2001 and shall be called **National Transmission Company (TransCo)**. NPC shall also turn over its transmission assets to the said newly formed TransCo. Moreover, TransCo shall sell the subtransmission assets to qualified distribution utilities on or before the end of 2003.

### Coverage

The transmission asset is broken down into two classifications namely Transmission and Subtransmission assets. Figure 1 shows the transmission asset coverage of the TransCo in **circuit kilometers (CKM)**, bulk of which are located in the Luzon Grid. Transmission asset is defined as the main highway of TransCo in providing transmission service to the generating resources and delivering power to distribution utilities and directly connected customers.

Figure 1. TRANSMISSION ASSET (CKM)			
	TRANSMISSION	SUBTRANSMISSION	TOTAL
LUZON	6,251.71	3,397.45	9,649.16
VISAYAS	2,065.64	2,318.95	4,384.59
MINDANAO	3,111.29	2,459.47	5,570.76
PHILIPPINES	11,428.64	8,175.87	19,604.51

Subtransmission asset is defined as the lines, which are being used by distribution utilities to provide electric service to its native customers. Subtransmission asset may be defined also as a line that caters to the need of a single user. Hence, those facilities that are already owned and dedicated for use by single customers shall be considered as subtransmission asset. If other customers will use the said line in the future, it will be considered as transmission asset. Figure 2 on the other hand shows the distinction between the transmission and subtransmission assets based on voltage level.

Figure 2. DISTINCTION BETWEEN TRANSMISSION AND SUBTRANSMISSION ASSETS		
	Transmission	Subtransmission
Luzon	230kV and Up	115kV and below
Visayas	69kV and up	Below 69Kv
Mindanao	138kV and up	69kV and below

For Luzon Grid the main highways for power transmission are 230kV, 350kV HVDC and 500kV transmission lines. Generally, the 115kV transmissions lines and below are the subtransmission lines being used by the Manila Electric Company (distribution utility) in delivering power to its native customers. For Visayas Grid the main highway for power transmission are the 69kV lines. For Mindanao Grid the main highway for power transmission are the 138kV lines.

Figure 3 shows the peak demands, energy generation, estimated wheeling rates and estimated income per day of the three power grids. The projected gross income of Transco is roughly P39 million per day or P14 billion per annum equivalent to US\$280 million.

Figure 3. PEAK DEMANDS & PROJECTED GROSS INCOME PER DAY OF TRANSCO				
Grid	Peak Demand (MW)	Generation/Day (kWH)	Wheeling Rates	Gross Income/day
Luzon	5650	100,000,000	P0.30	P30,000,000
Visayas	805	15,000,000	P0.30	P4,500,000
Mindanao	864	16,500,000	P0.30	P4,950,000
Philippines	7319	131,500,000	P0.30	P39,450,000 or \$774,000

### **Guiding Principle**

The ownership of the wires business shall be a national franchise and regulated common electricity carrier business. Since the transmission of electricity is of public interest, this shall be under the ratemaking powers of the Energy Regulatory Commission (ERC). This rule shall apply to the wheeling rates to be collected and ancillary services to be provided by TransCo or the buyer/concessionaire or any other successor-in-interest thereto.

### **Salient Features Of Transmission Sector**

Transco or buyer/concessionaire shall be the new owner of the transmission and subtransmission assets. Within a period of two years the TransCo shall sell the subtransmission assets to qualified distribution utilities. The Philippine Grid Code and Distribution Code shall be used as manuals in the operation of the transmission and subtransmission systems respectively. Moreover, TransCo shall purchase the ancillary services from qualified generating resources, rates shall be fixed by the ERC after due notice and public hearing. These ancillary services shall include spinning reserve, load following, frequency regulation, energy imbalance, blackstart capability, transmission losses and voltage support.

TransCo shall open the system to all interested customers who want to avail of its transmission service. Open access refers to the non-discriminatory provision of the services to any qualified customer without regard to ownership but nevertheless subject to system security constraints.

### **Roles of TransCo**

TransCo shall perform the job of a system operator. All generators who availed of the transmission service of TransCo shall be subject to central dispatch. TransCo shall handle initially the market operation function until such time the wholesale electricity spot market (WESM) is set up in 2004. Until such time that WESM is not yet established, Transco shall use the transition rules developed by the Department of Energy. TransCo shall be in charge of the preparation of the Transmission Development Plan subject to the approval of the Department of Energy. TransCo may perform other related business to augment its income, such as system impact studies and preventive maintenance of Generation Company's (GenCo) switchyards, etcetera.

TransCo shall collect wheeling fees from the GenCos who availed of its transmission service, rates subject to approval of ERC. TransCo is mandated to provide system security, reliability, adequacy, stability and integrity in accordance with the performance standards for the operation of the Grid. TransCo shall operate and maintain the Sub-transmission Assets until such time they are disposed to the qualified distribution utilities. Hence, the TransCo shall assume the authority and responsibility of NPC for the planning, construction and centralized operation and maintenance of its high voltage transmission facilities, including grid interconnections and ancillary services.

## Performance Standards

The performance indicators for reliability, security, adequacy, integrity and stability shall include but are not limited to the following:

Transmission Sustained Average Interruption Frequency Index (T-SAIFI) - measures the frequency of outages that are considered as sustained in nature, which is MVA based index.

$$\text{T-SAIFI} = \frac{\text{Connected MVA Impacted by Outages} > 10 \text{ min}}{\text{Total Connected MVA for system considered}}$$

Transmission Momentary Average Interruption Frequency Index (T-MAIFI) - measures the frequency of outages that are considered transient in nature, which is MVA based index.

$$\text{T-SAIFI} = \frac{\text{Connected MVA Impacted by Outages} < 10 \text{ min}}{\text{Total Connected MVA for system considered}}$$

Transmission Sustained Average Interruption Duration Index (T-SAIDI) - measures the average number of minutes power to customers are restored

$$\text{T-SAIDI} = \frac{\text{Sum of (Outage MVA x Minutes)}}{\text{Total Connected MVA for Area}}$$

System Interruption Severity Index measures the severity of interruptions of system unreliability, expressed in system minutes (or Hours). This index compares one year with another.

$$\text{SISI} = \frac{\text{Sum of Unserved Energy (MW lost x duration (minutes))}}{\text{MW system peak}}$$

According to IEEE, the impact of interruption can be grouped into the following ranges.

Degree	Meaning
0	Unreliability condition is less than one system minute
1	Unreliability condition is one to ten system minutes
2	Unreliability condition is 10 to 100 minutes
3	Unreliability condition is 100 to 1000 minutes
4	Unreliability condition is above 1000 minutes

Frequency Of Tripping Per 100 CKM measures the number of forced line outages (transients & permanent or sustain) initiated by automatic tripping of relay

$$\text{FOT} = \frac{\text{Total Number of Trippings}}{\text{Circuit length per 100 CKM}} \quad \text{(for voltage level 69kV \& above)}$$

Average Forced Outage Duration measure the average time needed to repair or restore an equipment or transmission line after a fault or maintenance

$$AFOD_F = \frac{\text{Forced Outage Hrs}}{\text{Number of Forced Outage Incidents}} = \frac{FOH}{FO \text{ trips}}$$

$$AFOD_M = \frac{\text{Maintenance Outage Hrs}}{\text{Number of Maintenance Outage Incidents}} = \frac{FOH}{MO \text{ trips}}$$

Accumulated Time Error measures the time deviation in seconds for the day, less than 4 seconds is passing and over is failure.

Frequency Limit Violations measures the number of frequency excursions on a per day basis. The frequency range used is +/-5% from nominal value of 60Hz.

Number of violations for the upper and lower limits shall not exceed 20 excursions per day to be considered passing.

Voltage Limit Violations measures the voltage deviation expressed in root mean square. The voltage range used is also +/-5% of the nominal voltage value. The average reading of the voltage value for the day should not exceed 218.5kV to considered passing for that day.

## Summary

The transmission sector promotes,

- Reforms in the electric power industry
- Regulation for consumer protection and empowerment
- Privatization of transmission/subtransmission assets

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# BACKGROUND

## BEFORE

- ★ GENERATION & TRANSMISSION
- ★ GOCC DOMINANT (NPC)

## NOW/SOON

- ★ GENERATION
  - PRIVATIZED
- ★ TRANSMISSION
  - PRIVATIZED
  - TRANS ASSET TO TRANSCO OR BUYER/ CONCESSIONAIRE
  - SUBTRANS ASSET TO DU'S

# TRANSMISSION ASSET COVERAGE

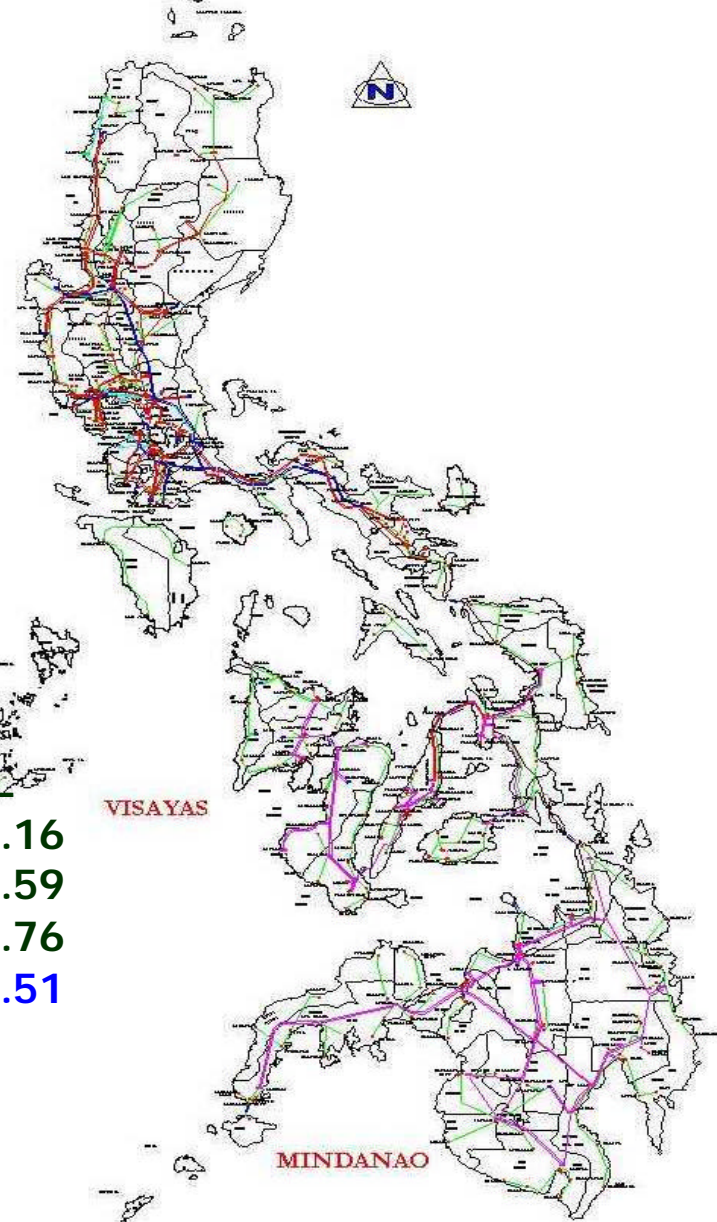
NPC TRANSMISSION ASSET (CKM)			
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PHILIPPINE GRID

LUZON

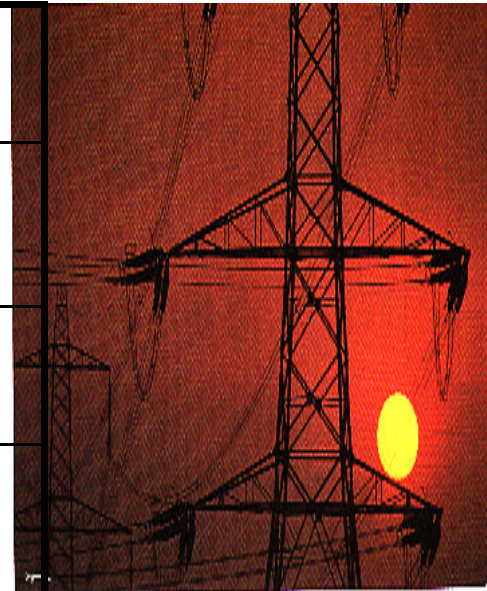
VISAYAS

MINDANAO



# Classification of Transmission Assets & Peak Demands per Grid

	Transmission	Subtransmission	PEAK LOAD
Luzon	230kV and above	115kV and below	5650 MW
Visayas	69kV and above	Below 69kV	805 MW
Mindanao	138kV and above	69kV and below	864 MW



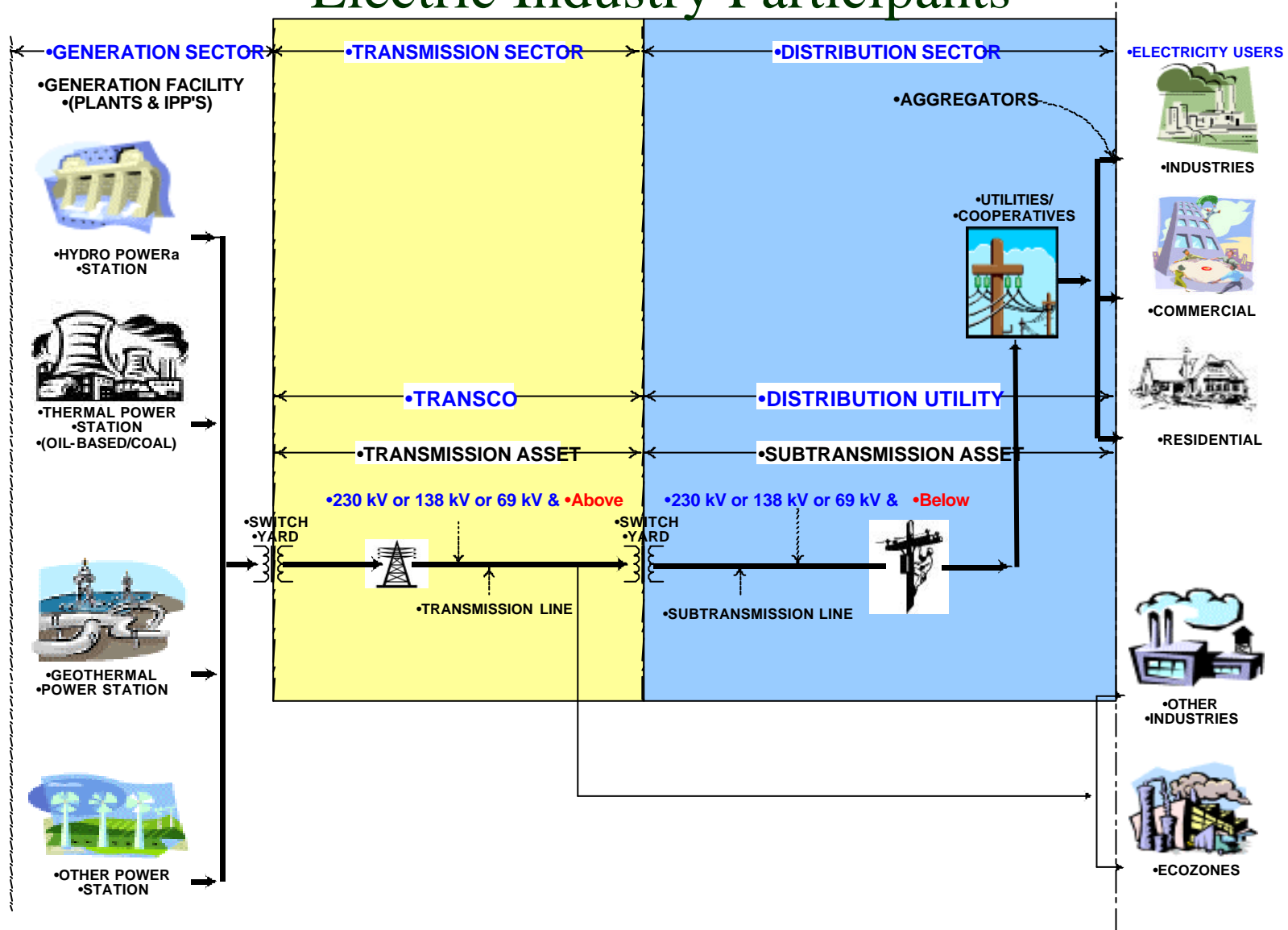
# Projected Gross Income/day of TransCo

	Generation/Day (Kwh)	Wheeling Rate	Gross Income/Day
Luzon	100,000,000	P0.50	P50,000,000.00
Visayas	15,000,000	P0.50	P7,500,000.00
Mindanao	16,500,000	P0.50	P8,250,000.00
Grand Total			P65,750,000.00 or US\$1,277,000.00

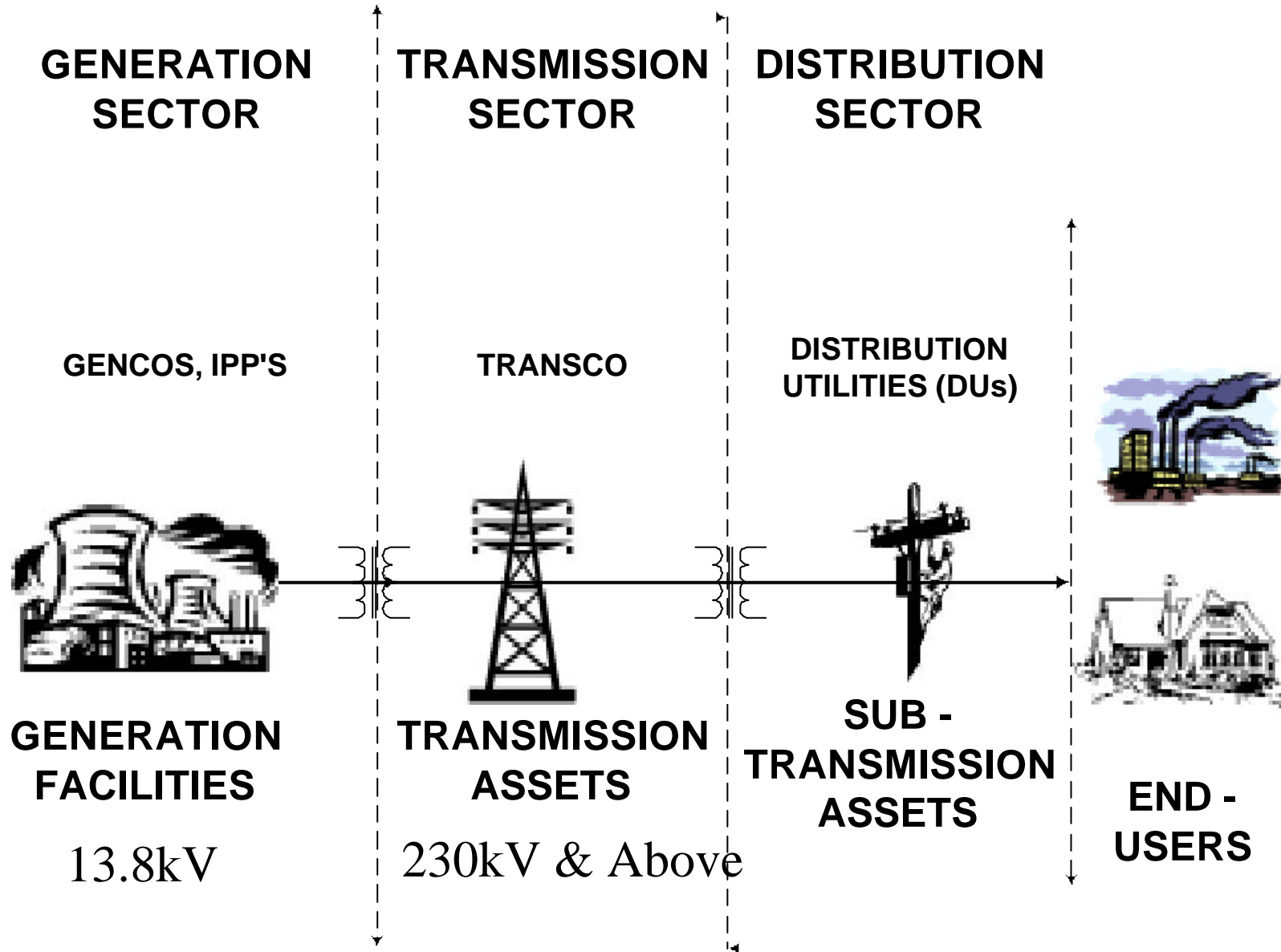
# GUIDING PRINCIPLE

- ★ NATIONAL FRANCHISE
- ★ COMMON ELECTRICITY CARRIER BUSINESS
- ★ PUBLIC INTEREST/REGULATED RATES
- ★ NON-DISCRIMINATORY OPEN ACCESS
- ★ TRANSCO OR BUYER/ CONCESSIONAIRE

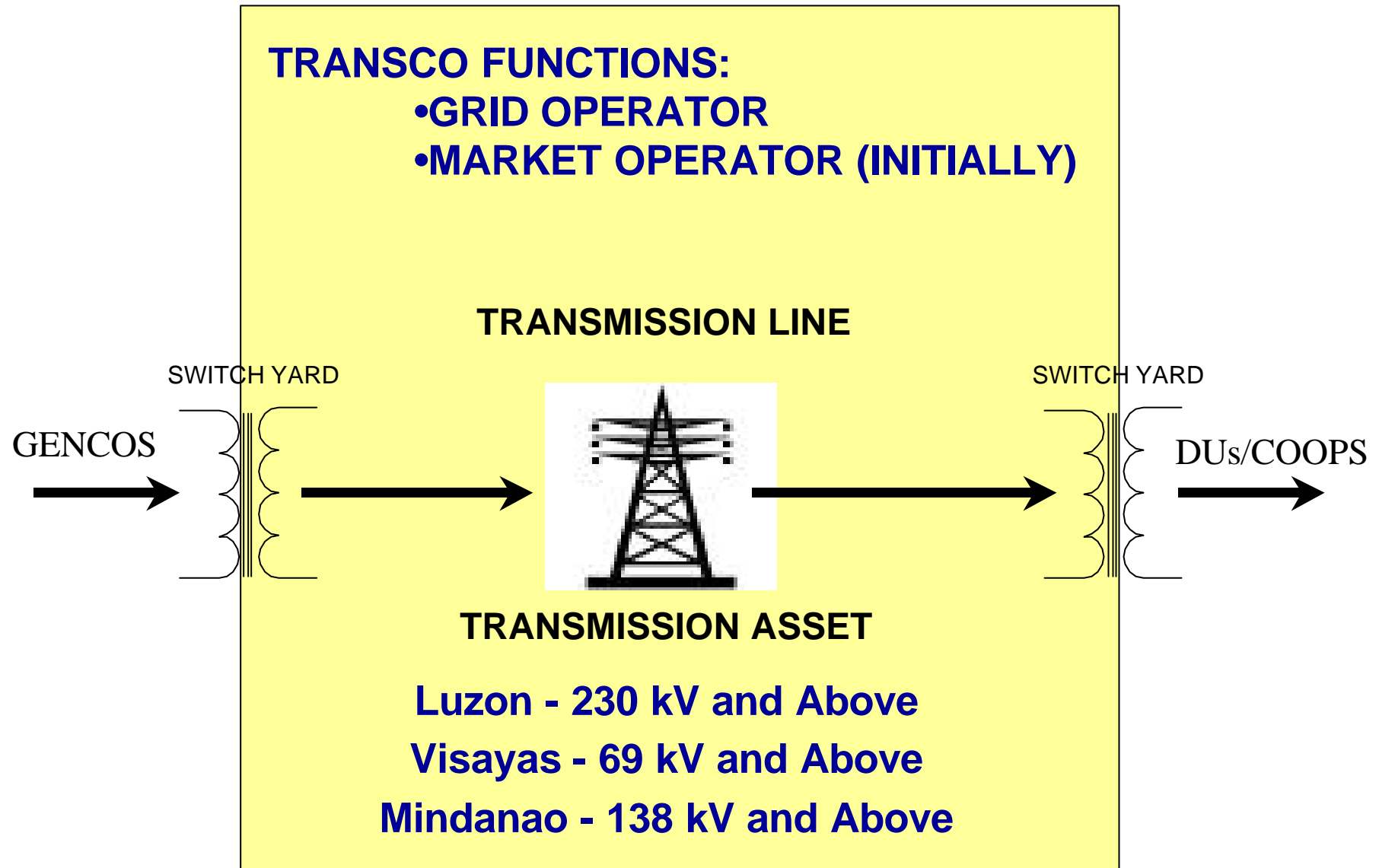
# Electric Industry Participants



# ELECTRIC INDUSTRY PARTICIPANTS



# TRANSMISSION SECTOR



# **SALIENT FEATURES OF TRANSMISSION SECTOR**

- ★ **TRANSMISSION  
ASSET**

- ONLY TRANSCO OR  
BUYER  
CONCESSIONAIRE

- ★ **SUBTRANSMISSION  
ASSET**

- DISTRIBUTION  
UTILITIES
- NOT LATER THAN 2  
YRS.

- ★ **OPEN ACCESS**

- ★ **PERFORMANCE**

- GRID CODE
- DISTRIBUTION  
CODE

- ★ **REGULATED  
RATES**

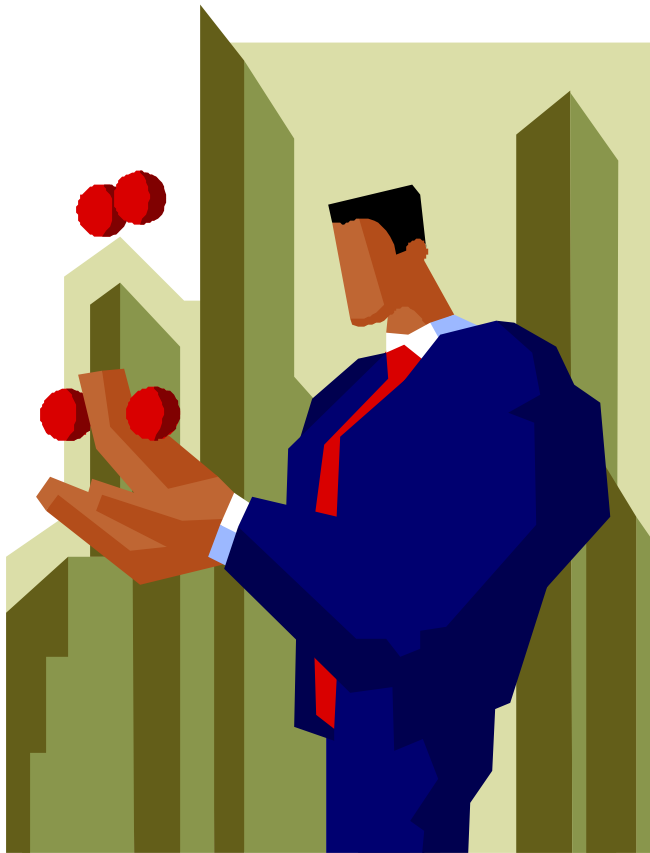
- ★ **OTHER RELATED  
BUSINESS**

# Roles of Transco

- ★ **System Operator**
- ★ **Market Operator (initially)**
- ★ **Preparation of TDP**
- ★ **System Impact Studies**
- ★ **Collect wheeling fees, rates subject to approval of ERC**



# Roles of TransCo cont..



- ★ In charge of System
  - Security
  - Reliability
  - Adequacy
  - Stability &
  - Integrity

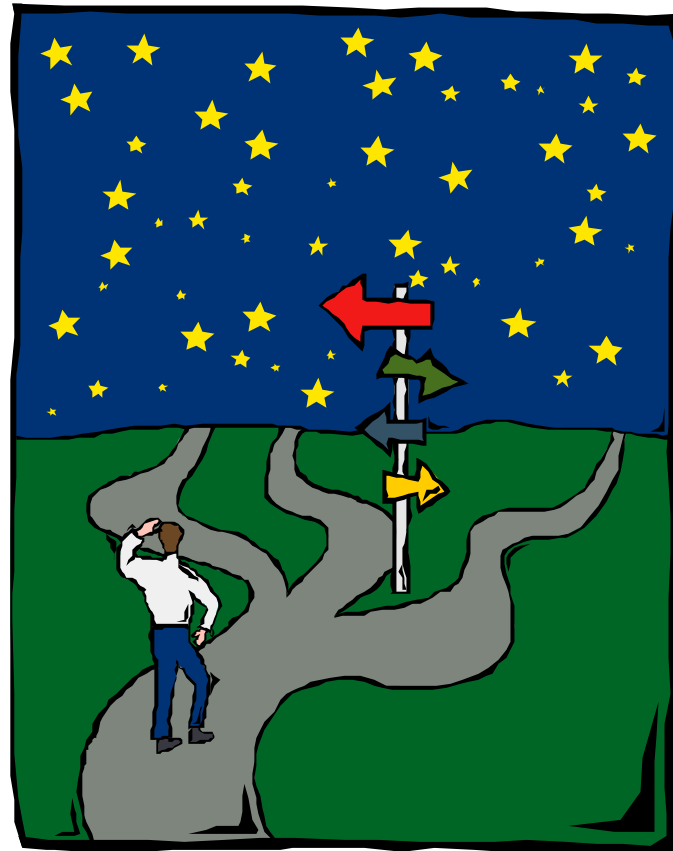
# Roles of Transco cont..

- ★ Responsible for the
  - Improvement
  - Expansion
  - Operation &
  - MaintenanceOf the transmission assets.



# Roles of TransCo cont..

- ★ Provide Ancillary services
  - Spinning Reserve
  - Load Following
  - Energy Imbalance
  - Blackstart Capability
  - Transmission Losses
  - Voltage Support



# Transmission Performance Standards

- ★ Trans. Sustained Average Interruption Frequency Index (T-SAIFI)
- ★ Trans. Momentary Average Interruption Frequency Index (T-MAIFI)
- ★ Trans. Sustained Average Interruption Duration Index (T-SAIDI)
- ★ System Interruption Severity Index
- ★ Frequency Of Tripping
- ★ Average Forced Outage Duration
- ★ Accumulated Time Error
- ★ Frequency Limit Violations
- ★ Voltage Limit Violations

# SUMMARY

## THE TRANSMISSION SECTOR PROMOTES:

- REFORMS IN THE ELECTRIC POWER INDUSTRY
- REGULATION FOR CONSUMER PROTECTION AND EMPOWERMENT
- PRIVATIZATION OF TRANS/SUBTRANS ASSETS